No 3.

A
PRACTICAL ESSAY
ON A
Cement and *Artificial Stone*,

Juſtly ſuppoſed to be THAT of
The GREEKS and ROMANS,

LATELY RE-DISCOVERED
By Monſieur LORIOT,
Maſter of Mechanics to His Moſt Chriſtian Majeſty,

FOR THE
Cheap, eaſy, expeditious and durable Conſtruction
of all Manner of Buildings;

AND
The Formation of all Kinds of Ornaments of Architecture,
even with the commoneſt and coarſeſt Materials.

Tranſlated from the *French* Original, lately publiſhed, by the expreſs
Orders of the Above-mentioned Monarch.

Ruinarum urbis ea maximè cauſa, quòd furto calcis ſine ferrumine ſuo,
cœmenta componuntur. Plin. Hiſt. lib. 36 cap. 23.

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M,DCC.LXXVI.

TO THE

KING.

SIRE!

THE original of this Eſſay having been publiſhed in France, by the ſpecial Command of the French King; it ſeems but natural, that the tranſlation of it ſhould make its appearance, here in England, under the auſpices of Your Majeſty. Indeed, the importance of the Subject might alone ſuggeſt to me the propriety of ſeeking, for it, the patronage of a Monarch, whoſe knowledge of, and acquaintance with, all the means of making His ſubjects happy, can only be ſurpaſſed by His zeal to employ them. May I, therefore, Sire, moſt humbly beg leave to lay it, for that purpoſe, at Your Majeſty's feet, and ſubſcribe myſelf, with the warmeſt affection and moſt profound veneration,

May it pleaſe Your Majeſty,

Your Majeſty's

moſt dutiful

and moſt obedient ſubject,

The Tranſlator.

A

PRACTICAL ESSAY, &c.

NOtwithſtanding the great degree of perfection, to which the arts have attained within a few centuries, it cannot be denied, that, in looking over the writings of the ancients, and examining their monuments, we meet with certain ſigns of their having been acquainted with ſome ſecrets, to which we moderns are utter ſtrangers, We are, no doubt, very rich without them; but that is no reaſon why we ſhould not endeavour to recover them; and, inſtead of truſting to chance, employ both obſervation and experiment for that purpoſe.

Of this, one of the moſt important branches of architecture is a ſtriking proof. Though the genius of our modern maſters in that art, formed by the ſtudy of thoſe monuments left us by the ancients, has ſucceeded ſo far, as to produce edifices capable of vying with their patterns, it may be fairly ſaid, that we are ſtill at a great remove from the Greeks and Romans with reſpect to the running up of buildings with the degree of rapidity they uſed to do; and yet beſtowing on them that degree of ſolidity, which ſeems to defy time itſelf; and all this, with almoſt every kind of materials they could lay their hands upon.

It is, no doubt, an eaſy matter to raiſe laſting edifices, by piling, one upon another, enormous blocks of ſtone: But, then, there are ſeveral countries, of very conſiderable extent, in which no ſuch materials are to be had; and there are others, in which, though theſe materials abound, they are of too looſe a texture to reſiſt, for many years, the viciſſitudes of the weather. Beſides, this way of going to work is monſtrouſly expenſive. It is what very few ſimple ſubjects can pretend to; and, accordingly, few of the houſes built by them are of any duration. Nay, ſtates themſelves are now often obliged to renounce the execution of the moſt uſeful works, on account of the enormous expence attending them in the modern method.

But the Romans, it is plain, generally employed, eſpecially in thoſe public works in which uſefulneſs was more to be attended to than ornament, a far leſs expenſive mode of conſtruction. The principal parts of ſuch works, if not the whole of them, uſually conſiſted of materials of a very ſmall bulk, but kept together by a mortar or cement of a very binding quality.

lity. What a fine method! one can hardly ſum up all the advantages attending it. In it, they could make uſe of every kind of ſtuff already exiſting on the ſurface of the earth, and even ſtones every where almoſt to be met with in the beds of rivers and torrents, though worn round, nay, and poliſhed, by their conſtant attrition againſt each other or other bodies. (1) They had no occaſion for the unwieldy apparatus of heavy carriages to bring their materials to the ſpot, or cumbrous engines to raiſe them; conſequently, they loſt neither time nor labour in the execution of thoſe tedious operations; all went directly to the forwarding of the work itſelf, which, of courſe, muſt have ſhot up with uncommon rapidity. How, otherwiſe, could they have executed, even with their numerous armies, thoſe immenſe piles; thoſe aqueducts of ſeveral leagues in length, and ſometimes riſing to the level of mountains; and all this often, merely to ſupply ſome middling town with water, not only for the neceſſary, though common, purpoſes of life; but even thoſe of luxury and abundance; ſuch as baths, fountains, &c.

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(1) Of this we have an inſtance in the ruins of an ancient Roman building on the banks of the Rhone at Lyons, a little above St. Clare's quay. It is eaſy to ſee, that even the pebbles found in the bed of this river make a part of the work; but they are ſo ſtrongly bound together, that it is much eaſier to break them, than to make them let go their hold of the cement, which fills all the interſtices between them.

Theſe conſiderations did not eſcape Monſieur Loriot, ſo deſervedly celebrated for his many very uſeful mechanical diſcoveries and inventions; and it was in conſequence of them he made theſe enquiries and reſearches, the fruits of which I am now going to communicate to the public. Ever taken up with the thoughts of ſerving his country and mankind, by cultivating and improving the fine and the uſeful arts, the great number of thoſe vaſt remains of Roman grandeur, ſcattered over our ſouthern provinces, could not fail of ſuggeſting to him, that the ſolidity, ſo conſpicuous in them, could not be owing to any ſecret confined to any one portion of mankind, nor to any merely local advantages, nor to any peculiar excellency in the quality of the materials; but that it muſt be the reſult of ſome common and eaſy method, within the reach of every man of the world of workmen, employed in theſe erections. But, perhaps, we had better follow the example of Monſieur Loriot; and, like him, particularly analyſe theſe ſtupendous monuments, and thence regularly deduce the manner, in which it may be preſumed the Romans conſtructed them.

Moſt of theſe monuments exhibit nothing but enormous maſſes in point of thickneſs and height, the heart of which, but juſt faced, with an almoſt ſuperficial coating, evidently conſiſts of nothing but pebbles and other ſmall ſtones, thrown together at random, and bound by a kind of mortar, which appears to have been thin enough to penetrate the ſmalleſt interſtices, and ſo form a ſolid whole with theſe materials, which ever kind was firſt laid to receive the other, when poured into it.

It is enough therefore to conſider theſe ruins, with the ſmalleſt degree of attention, to be convinced, that all the ſecret of this mode of conſtruction conſiſted in the method of preparing and uſing this ſtrange kind of mortar; a mortar not liable to any decay; bidding defiance equally to the perpetual eroſions of time, and heavieſt ſtrokes of the hammer and pick-axe. At leaſt, when any little ſtone, and it muſt be a round one, gives way to them, the mould of cement left by it is found equally hard with the compleateſt petrification.

How different, then, muſt this ancient mortar be from the beſt of our modern! the latter, one would imagine, never dries perfectly but to fall to duſt again at the leaſt touch. Of this the remarkable crumbling away of our moſt recent buildings is an evident proof.

Another of the extraordinary qualities of this Roman cement, is its being impenetrable to water. This is not a mere conjecture. It is a fact, which the aqueducts of theirs, ſtill in being, leave not the leaſt room to doubt of; for, in theſe works, they never employed either clay, maſtich, or any other reſinous ſubſtance, to prevent the waters making their way through them. The areas of theſe canals, reſting ſometimes on the ground, ſometimes on a wall, and ſometimes on arches built for the purpoſe, as well as their roof and ſides, conſiſting of the ſame kind of ſmall ſtones bound together by this extraordinary cement; with this difference, that the inſide ſurface was compoſed of finer and ſmaller ingredients; which, at the ſame time that it does not look any thing like a coating made at ſecond hand, and of courſe capable of being ſcalded off, carries evident marks of its being the reſult of a peculiar operation, which it may not be impoſſible to imitate by attending to the obſervations, that will occur in the courſe of this Eſſay.

Thus, then, it plainly appears, that theſe works were carried on by means of caſſoons. The trenches made for the foundation formed, of themſelves, the loweſt tire; and, ſurely, nothing could be eaſier than to fill theſe with the materials ready prepared for that purpoſe; tho' the Romans, no doubt, did it with their largeſt and heavieſt ſtones. After bringing the work to the ſurface, they had recourſe to planks made to fit into each other, ſucceſſively extending them in length and in heighth, and binding the oppoſite ones at ſuch a diſtance from each other, as to form the thickneſs of the wall;

and withal with ſufficient ſtrength not to deviate ever ſo little, from the perpendicular, on either ſide.

It was, thus, that they formed, as it were in a mould, theſe enormouſly maſſive walls, compoſed, as we have already ſeen, of every ſpecies of pebbles and other ſmall ſtones, which our modern architects know not what to do with for want of a mortar qualified to conſtitute with them one ſolid compact body.

We may eaſily conceive, at what a great rate, even a ſmall number of hands, if well ſupplied with materials, muſt have been able, by this means, to puſh on any work in the building way. For this purpoſe, nothing more was requiſite than to have in readineſs a ſufficient number of troughs full of the proper mortar; throw at random into the caſſoons, the pebbles and other ſmall ſtones; and then ſaturate the latter with the former; all which might be perfectly well done, by the ſmalleſt degree of attention to get as much ſtones as poſſible into the caſſoon; and then make the mortar fill up all the interſtices between them; and, with regard to vaulting and arching, they had their centers, as well as the moderns. When they had an aqueduct to build, then, as the interior ſurfaces of its channel required a coating of that peculiar cement, which is ſtill obſervable in them to a certain thickneſs, and which we have already taken notice of, they began by laying it on the planks of the interior caſing and the centers, previous to the throwing in of the coarſer materials; and thus formed a cruſt, which effectually kept the water from any ſtones of a ſpungy nature, that would otherwiſe have imbibed it.

Without this method of caſing, they would never have been able to conſtruct, either walls of ſo prodigious a thickneſs, or channels of ſo ſurpriſing a thinneſs. In a word, the effect of this cement muſt have been very quick, to coaleſce, and ſet as readily as our gypſes and plaſters, and directly reſiſt the preſſure of the other materials laid upon it. In fact, the leaſt ſhrinking or ſwelling muſt have proved fatal to works of this kind, not one of whoſe parts, perhaps, yielded a ſolid and horizontal baſis to any other.

This fixedneſs and perſeverance within the ſame volume conſtitute another important quality, which the ſlendereſt obſervation muſt convince us the Roman cement is endued with; and being the laſt as yet diſcovered, we may proceed to ſum up all the excellencies peculiar to this extraordinary compoſition.

In the firſt place, then, this cement, from a liquid, turned very quickly to a ſolid ſtate, and hardened with time as plaſter does.

Secondly, it acquired a ſurpriſing degree of tenacity, and laid ſuch hold of the ſmalleſt ſtones, it came in contact with, as ſcarce to bear being parted from them.

Thirdly, it was impenetrable to water.

Fourthly, it continued always of the ſame volume or bulk, without either ſwelling or ſhrinking.

One would imagine, that ſo many extraordinary qualities ſhould have ſecured this compoſition from the effects of violence and time, and kept the ſecret of it alive to the lateſt poſterity. Yet, it may be ſafely affirmed, that this valuable ſecret has been loſt to all intents and purpoſes; and that, notwithſtanding the continued and hearty ſighs and reſearches of all Europe, nothing like it, till now, has been diſcovered by the moderns. For, if, in ſome parts, the buildings are more ſolid than others, it is merely owing to the extraordinary goodneſs of the lime, ſand, and other materials employed in them.

No doubt, Monſieur Loriot was not the firſt to examine the nature of the ſtill exiſting remains of Roman grandeur. Nay, many other lovers of antiquity may have been equally careful to compare all the circumſtances of theſe monuments, from which any inſight into their conſtruction could be derived; and many have even analyſed more methodically the cement in them; but no one, beſides himſelf, that I know of, has as yet been bold enough to affirm, that, with all his reflections and trials, he had been able to recover the long loſt ſecret of its compoſition.

Is it poſſible, then, that theſe gentlemen ſhould have concluded, along with the vulgar, that the Romans, not finding any materials in their country fit for ſuch cement, brought them to Italy; or, if they found any, that the veins, which then ſupplied them, have been long ſince exhauſted? Abſurd, however, as ſuch conjectures muſt be, they are not of ſo diſcouraging a nature as thoſe of the wine-dreſſers in the environs of Beſançon, who make no ſcruple of telling each other that the aqueduct of Arcier (2) is indebted for its ſolidity, to the uſing of bullocks blood in the making of its cement; a circumſtance, they, no doubt, infer from the reddiſh and bricky clouds in it. But theſe clouds are of no weight with obſervers better qualified to judge of the matter, who, whether they abide by the evidence of their eyes, or have recourſe to analytical decompoſition, can find no ingredients in it, but ſuch as are to be found in the commoneſt mortar now in uſe.

(2) Quin et aquæ ſupereſt ductus per millia quinque,
Ad mea qui quondam mœnia vexit aquas.
Deſpotots apud Chifl. Veſont.

And, indeed, how can the Romans, with all their power, be ſuppoſed to have brought from ſo great a diſtance the mountains of materials neceſſary for ſo many and ſuch vaſt conſtructions! and, ſurely, it is equally abſurd to think, that they ſhould have diſcovered, preciſely at the time when, and on the ſpots where, they wanted theſe materials, ſuch preciſe quantities of them, as not to leave their ſucceſſors the leaſt opportunity of doing the great things they did. No, ſuch ideas might be juſtly deemed extravagant, even though their cement, on being decompoſed, were to yield any extraordinary ſubſtance, or exhibit any phenomena the moderns were yet unacquainted with.

But, Monſieur Loriot, after examining, in the courſe of his travels, almoſt all the monuments of this kind left by the Romans in France; after conſidering all the materials nature afforded in the places where they erected them; after, in ſhort, comparing and combining all their poſſible local reſources; found himſelf obliged to confeſs, from the cleareſt conviction, that they employed no materials but what we ſtill employ; that their cement owed all its excellency to the lime, ſand, brick-duſt, and other materials of that kind, with which they made it; but that they had another method of mixing up theſe materials, and uſing the mixture.

This ſyſtem, uncommon and bold as it might then appear to be, not only kept poſſeſſion of his mind; but ſunk deeper into it from day to day, in conſequence of the new obſervations he had frequent opportunities of making, till, at length, in the beginning of the year 1765, he took upon him, for the firſt time, to preſent the Royal Academy of Architecture a memorial, in which he gave his opinion, and laid down his reaſons for it, with regard to both theſe points; to wit, the ſameneſs in the ſubſtance of the materials, and difference in the manner of mixing them. And, having already convinced himſelf of the inertneſs and ſufficiency of lime that had been ſlaked for any conſiderable time, he ſcrupled not to aſſert, that the Romans uſed quick-lime on their ſcaffolds; and that it was to its vivifying quality we were to attribute all the wonderful effects of this cement.

The Marquis de Marigny, director and ſurveyor-general of the king's works, having received a copy of this piece, condeſcended to read it with all that zeal for his majeſty's ſervice, the advancement of the arts, and the welfare of the public, for which he is ſo diſtinguiſhed. He immediately ſaw that the fine proſpects it afforded, were far from being viſionary; and he no ſooner ſaw it, than he did Monſieur Loriot the honour of writing to him, to encourage him in the purſuit of ſo promiſing a ſcheme. His letter is dated the 13th of February, 1765; and contains a great number of obſervations, analogous to Monſieur Loriot's ſyſtem on the uſe of quick-lime in Italy, and particularly at Naples, in conjunction with what they call *rapillo* and *pozzolana*.

This letter gave room to another memorial; and both were preſented together to the ſame academy. But this body, then, it may be, taken up with objects more worthy of its attention, or biaſſed perhaps by the report made to it concerning theſe memorials, received them with a great deal of coolneſs. But, however mortified Monſieur Loriot muſt have been at this treatment, he was not diſcouraged by it. Inſtead of imputing it to the academy in general, he attributed it to ſome of its members in particular, from whom he knew he had no favour to expect; and to a prejudice againſt his opinion, which he could not but allow to be pretty natural, and tolerably well grounded, ſince it is countenanced by the two only ancient writers upon the ſubject, whoſe works are come down to us.

In fact, theſe gentlemen did not forget to object to him the teſtimonies of Virtruvius and Pliny; eſpecially that of the firſt, who, in his architecture, beſtows the greateſt praiſes on the lime which has been the longeſt ſlaked; ſo as to leave but little hopes to any future artiſts of being able to introduce the uſe of quick-lime, or at leaſt lime ſlaked in the very act of uſing it. Monſieur Loriot, therefore, thinks it incumbent on him to diſcuſs the paſſages in thoſe authors, which have been alledged againſt him; and ſhew, that all the proof, which could be drawn from them to the prejudice of his ſyſtem, is at beſt of a negative nature, and withal ſo very confined, as not to deſerve being put in competition with ſuch well atteſted facts, as he produced in ſupport of it.

In the firſt place, with regard to Vitruvius, it does not appear, that he has any where condemned the uſe of quick-lime; for, when, in the ſecond chapter of his ſeventh book, he recommends that which has been long ſlaked, it is merely for the making of plaſter, on account of its being then too well diſſolved, to contain any grains or lumps, which might ſpoil the work.(3) There is, beſides, ſome reaſon to ſuppoſe, that Vitruvius was by no means as well acquainted with the practice of architecture, as with the theory of it; for, he does not cite a ſingle building as of his own erecting; and, in this caſe, it is very poſſible, he might have overlooked an operation confined to the ſcaffold.

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(3) De maceratione calcis ad albaria opera: *ſuch is the title of this chapter, which is the ſecond of the ſeventh book.* . . . . . . Tum de albariis operibus eſt explicandum. Id autem erit rectè, ſi glebæ calcis optimæ, ante multo tempore quàm opus fuerit, macerabuntur. Namque, cum non penitus macerata, ſed recens ſumitur. . . . . . habens latentes crudos calculos puſtulas emittit. . . . . . Qui calculi diſſolvunt et diſſipant tectorii politiones.

Pliny, indeed, ſeems to have affirmed more clearly, in the twenty-third chapter of the thirty-ſixth book of his hiſtory, that the older lime is, the better. (4) But, unleſs we take particular care to diſtinguiſh, in this paſſage of his, the two propoſitions it contains concerning lime; and, firſt, make ourſelves thorough maſters of the firſt propoſition; we ſhall ſtrive in vain to underſtand the ſecond. This author, who wrote from a collection of materials, in conformity to which, he digeſted his chapters with ſuch peculiar preciſion, as often leaves his readers in the dark, in this place evidently ſpeaks of lime in two different ſtates; one, in which it is poſſeſſed of all its ſtrength, all its activity, all its *ferrumen*, which Monſieur Loriot, in his firſt memorials, ſtiles its *gluten*; and it is the abſence of this quality, which Pliny, in the firſt part of the foregoing paſſage, means by the words, *calcis ſine ferrumine ſuo*.

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(4) Ruinarum urbis ea maximè cauſa, quod, furto calcis, ſine ferrumine, ſuo cœmenta componuntur. Intrita quoque quò vetuſtior, eò melior. In antiquarum *(antiquis)* Ædium legibus invenitur, ne recentiore trimâ uteretur redemptor; ideo nulla *(nullæ)* tectoria eorum rimæ fœdavere. Plin. Hiſt. lib. 36. chap. 23.

Thus, then, the naturaliſt, as no ſtranger to the abuſes which in his days already began to creep into the building art, chiefly attributes the quick decay of the then modern buildings at Rome, to a defalcation her architects now began to make in the compoſition of their mortar; (5) a defalcation, which he ſtiles a theft, *furto*; and the ſubject of this theft was a lime, the withholding of which deprived the mortar of that tenacity and ſtrength it uſed formerly to derive from its preſence; *furto calcis ſine ferrumine ſuo, cœmenta componuntur.*

Pliny does not ſay, that the abuſe conſiſted in making mortar without lime; for, we are not to imagine, that, in his days, the Roman architects were wild enough to entertain any ſuch thoughts; or, if they were, that he would not have contented himſelf with the mention of this ſubſtraction in abſolute terms; and not have dignified with the name of *cæmenta* the paltry compounds adopted in the room of them. No, he ſpeaks of the with-holding of a ſpecies of lime, which alone could confer on the mortar thoſe valuable properties, every builder muſt wiſh to find it poſſeſſed of; and this we cannot allow to have been ſlaked-lime, ſince the leaſt experience is ſufficient to convince us, that, let ſuch ſlaked-lime be ever ſo old, and uſed in ever ſo great a proportion, though in one degree of combination it may afford a ſomewhat better mortar than in another, it will never afford a mortar, in any reſpect equal to the good mortar of the Romans.

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(5) It is well known, that the word *cæmentum* is not always uſed by the latin authors to ſignify cement or mortar. But, in this paſſage of Pliny, it can ſignify nothing elſe.

There may be, therefore, according to Pliny, a theft of lime, a criminal thriftineſs with regard to it, to which we are to attribute the badneſs of the mortar, which about this time began to be uſed in Rome, and proved the ſource of thoſe ruins that disfigured her. But this theft cannot be that of lime which, has been long ſlaked, ſince there is no mending mortar by reſtoring it to ever ſo large a quantity of ſuch long-ſlaked lime.

The conſequences therefore, ariſing from Pliny's aſſertion, and our own experience, are very obvious. In the firſt part of the paſſage in queſtion, he cannot poſſibly mean that lime which has been ſlaked, but a medium, to which the mortar is indebted for its ſtrength and efficacy. (6) This truth will appear more and more evident, in proportion as Monſieur Loriot's diſcovery unfolds itſelf; and we ſhall, of courſe, be apt to aſk ourſelves, how it could come to paſs, that, inſtead of looking into Pliny for authorities in ſupport of a blind and bad routine, we did not immediately perceive, what is, in fact, the principle of a wiſe practice, well known in his days, and which his writings, with a little more reflection on the ſide of the reader, were ſufficient to perpetuate? But the miſchief of it is, there are few readers who know how to read as they ought to do; and ſit down to their books with all the diſpoſitions requiſite to get the better of old prejudices.

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(6) In the beginning of this chapter, Pliny, it is evident, ſpeaks of the employment of quick-lime, which he calls *calcis quam vehementiſſimæ* ; ſo that every thing he ſays, till we come to thoſe words *intrita quoque*, *&c.* which ſhew that he is going to conſider lime in another ſtate, is to be underſtood of the quick-lime.

The ſecond part of Pliny's text, *intrita quoque, &c.* evidently means another ſpecies of lime, or another ſtate of it, different from that which made the ſubject of his firſt; he ſets them in oppoſition, as it were, to one another, In the firſt place, with regard to their names, he calls the firſt *calx* ſimply, or *calx cum ferrumine ſuo*, *calx quam vehementiſſima*; and gives the ſecond an epithet ſufficient to indicate the new ſtate, in which he has been conſidering it, calling it *calx intrita*,(7) lime diſſolved and ſlaked. Secondly, with regard to their effects, it is the firſt, which beſtows on mortar its ſtrength and conſiſtency; if you withhold it, you deprive the work of the ſolidity it ought to have: the ſecond is valuable on account of its having been long ſlaked, and being of courſe perfectly diſſolved, by which means the works in which it is uſed are not liable to any cracks or flaws; advantages, he adds, "enjoyed by our fore-fathers, in conſequence of their laws relating to building: which forbade the uſe of this kind of lime, within three years after the ſlaking of it."

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(7) *Intrita.* Can this word be underſtood of air-ſlaked, as well as water-ſlacked lime? if it may, Pliny muſt be allowed to have left room for a double conſtruction by uſing this expreſſion. We ſhall have hereafter occaſion to ſhew, that air-ſlaked lime is not deprived of all the qualities obſervable in water-ſlaked-lime.

But let the authority of Vitruvius and Pliny be what it will; and, by the bye, it is plain, theſe authors have not been well underſtood; it is of little conſequence to Monſieur Loriot; he has facts to ſpeak for him; ſad experience, indeed, has convinced him, that he muſt, notwithſtanding, engage with prejudice and jealouſy, much more formidable enemies, it muſt be allowed, to a man, who profeſſes to invent and reform, than any detached paſſages in authors, who have long ſince paid the tribute of nature, have now no longer any friends of cabal in their favour, and may, in an enlightened age like this, be ſafely contradicted, as often as there appear any ſubſtantial reaſo[illegible] for doing it.(8) Monſieur Loriot therefore proteſts, that he will employ no other weapon againſt his enemies, but his ſucceſs; nor any means to convince his detractors, or at leaſt ſilence them, but that of bidding them come and behold with their own eyes the trials, in great, of his method, which he is actually making, in the ſight of mankind, in thoſe works with which the king has been pleaſed to charge him. (9)

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(8) The author here means the perſecution Monſieur Loriot ſuffered with regard to the machines of his invention conſtructed at Pompean.

But, to return to our hiſtory of Monſieur Loriot's intereſting diſcovery, the enquiries begun by him on the plan he had lain down to himſelf in 1765, having ſuffered interruption, as well from ſome journies he was obliged to undertake, as from ſome private works for the king's uſe, (10) the Marquis de Marigny, whoſe zeal to forward every undertaking he has once found of conſequence to the improvement of the arts, and that of building in particular, knows no bounds, took advantage of a tour which Monſieur Loriot had occaſion to make to his eſtate of Menars, in 1769, to engage him to recollect and purſue his ideas with regard to the cement of the Romans; and withal make ſuch trials, as might ſpeedily bring his ſcheme to that degree of perfection, of which it might be capable, and which he thought it ſo well deſerved.

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(9) Monſieur Loriot is actually lining with his cement the vaulted roof of the orangery at Verſailles, where every body is free to come and ſee with what rapidity the work goes on, and with what quickneſs his cement takes without the betraying the leaſt diſpoſition to crack or flaw.

(10) Viz. The models of ſome flying tables, *(tables volantes,)* which are to be executed at Trianon, and which every connoiſſeur in the capital has ſeen and admired.

This requeſt had the force of a command with Monſieur Loriot; but a command ſo much the more eaſy to obey, as the Marquis at the ſame time gave orders for ſupplying him with every thing neceſſary to perform the taſk he had impoſed on him; being determined, that all the trials, both in the great and in the ſmall, ſhould be made entirely at his own riſk and expence; a noble inſtance of diſintereſtedneſs, ſuch as is rarely to be found even amongſt thoſe, who would be conſidered as firſt-rate patrons and protectors of the fine arts!

Monſieur Loriot, being by this means made as eaſy as he could wiſh, prepared the materials for his different mixtures, in the intervals of leiſure left him by a mechanical work, which he had undertaken for the purpoſe of raiſing water at Menars; and, in the courſe of the year 1770, had the happineſs to diſcover a kind of myſtery in nature, which, for ſeveral ages paſt, had not, it is moſt probable, manifeſted itſelf to any body but himſelf; a myſtery, on which all the merit of his diſcovery is founded.

Taking ſome lime, which had been a long time ſlaked, out of a pit covered with boards, and a conſiderable quantity of earth over them again, by which means the lime had preſerved all its original freſhneſs, he made two parts of it, and plaſhed and beat them both perfectly well.

He then put one of theſe parts, without any addition, into a glazed earthen pot; and, in that condition, ſet it to dry, of itſelf, in the ſhade. Here, in proportion as it loſt its moiſture by evaporation, it cracked and ſplit in every direction; parted from the ſides of the pot; and crumbled into a thouſand pieces, all of them equally friable with the bits of lime dried up by the ſun, which we uſually meet on the banks of our lime pits.

With regard to the other part, Monſieur Loriot juſt added to it one third of its quantity of powdered quick-lime, and then had the whole well kneaded, in order to make two kinds of lime perfectly incorporate with each other. This done, he put this mixture likewiſe into a glazed earthen pot, as he had done the firſt; when, behold, it ſoon began to heat, and, in the ſpace of a few minutes, acquired a degree of conſiſtence equal to the beſt plaſter, when prepared in the beſt manner. In ſhort, it ſet and conſolidated almoſt as readily, as metals in fuſion, when taken from the fire; and turned out a kind of inſtantaneous lapidification, having dried completely within a very ſmall ſpace of time, and that too, without the leaſt crack or flaw. Nay, it adhered ſo ſtrongly to the ſides of the pot, as not to be parted from them without breaking it.

The reſult of this addition of the quick lime, ſurpriſing as at firſt ſight it may ſeem, is, notwithſtanding, ſo eaſily explained and accounted for, that it ſeems ſomewhat ſtrange, that Monſieur Loriot ſhould be the firſt to ſuſpect and diſcover it. In fact, what can be plainer, than that the ſudden ſetting and conſolidating of theſe two ſubſtances, when thus united, muſt neceſſarily ariſe from the quick-lime's being carried, by a perfect amalgamation or admixture in the inmoſt receſſes of the ſlaked lime, ſaturating itſelf with the moiſture it there meets with, and thereby effecting that inſtantaneous and abſolute deſiccation, which, becauſe we are ſo well accuſtomed to it, we ſo little mind in the uſe of gypſes and plaſters.

But, the moſt valuable of all the extraordinary qualities in this compoſition is, its not being liable to any cracks or flaws, when the ingredients are in the exact proportion they ought to be; or to give way in any ſenſe, either by ſhrinking or ſwelling; or, in ſhort, ever undergo the leaſt alteration from that ſtate, in which its fixation left it; a phœnomenon we may account for on the ſame principles with the foregoing. Whereas mortar, or common cement, never dries but by the evaporation of its moiſture;

ſtute; Monſieur Loriot's cement becomes perfectly ſolid without the leaſt evaporation; its moiſture continues in, and makes part of it; the deſiccation is altogether inteſtine; and, as the maſs continues the ſame, and moreover the component parts of it are brought ſo near each other, it is impoſſible any cracks or flaws ſhould enſue; for, cracks and flaws can ariſe from nothing but the evaporation of a ſuperfluous moiſture, and the approach to each other of thoſe parts, which that moiſture had till then kept aſunder.

Monſieur Loriot had likewiſe the ſatisfaction to ſee, that his compoſition was endued with the ſurpriſing quality of being and continuing impenetrable to water. For this purpoſe, he made new trials; he formed, with his cement, ſome veſſels of a form proper to hold water; weighed them, filled them, and, after the water had ſtood in them a conſiderable time, emptied them; when, on weighing them a ſecond time, he could not find that they weighed either more or leſs than before he filled them.

After ſeveral repetitions of theſe trials, and always with the ſame ſucceſs, it now only remained to find out what effects, if any, time, or rather the viciſſitudes of the weather, might have on this mixture of the two kinds of lime, as well as on ſeveral other compoſitions, in which Monſieur Loriot had made it up with other materials fit for mortar; but, after making for this purpoſe a great number of new experiments, all the concluſion he could draw from them was, that not only the original mixture of the two kinds of lime, but every other to which he added it, inſtead of giving way to greateſt dryneſs or moiſture, heat or cold, in the air, encreaſed with age in ſolidity and compactneſs.

Monſieur Loriot now no longer made any ſcruple to affirm, that the mixing of powdered quick-lime with any kind of mortar or cement made with ſlaked lime, was the beſt way to give it all the perfections builders could wiſh to ſee it poſſeſſed of. This is the key to the diſcovery advertiſed by him; and the moſt intereſting conſequences flow ſpontaneouſly from it. However, I ſhall proceed to point out the chief of them. Further reflections and trials, nay chance itſelf, may, in the courſe of time, bring to light a great many more.

From the two kinds of lime ſo forcibly laying hold of and embracing each other, as it is plain from experience they do, ſo as to conſtitute but one ſolid body, it naturally follows, that they muſt likewiſe be able to ſeize and ſhackle ſeveral other kinds of ſubſtance, that may be mixed up with them, according to their greater or leſſer degree of ſuitableneſs to each other in point of ſurface and texture;

ſo as to add conſiderably to the maſs we are about to employ.

Now, ſand and brick-duſt are the foreign bodies which have as yet been found to anſwer beſt for this purpoſe.

Take, therefore, any quantity of very fine brick-duſt, and twice as much fine river ſand, the former well ſifted, and the latter well ſcreened, with a ſufficient quantity of old ſlaked lime to form, with water, an amalgama as uſual, but withal, wet enough to ſlake a quantity of quick-lime equal to one fourth of the brick-duſt and ſand taken together; then add the quick-lime in powder to the brick-duſt and ſand; incorporate them well without loſs of time, and uſe them directly, as the leaſt delay may render the uſe of them defective or impoſſible.(11)

A coating of this mixture, applied to the bottom and ſides of a canal, baſon, or any other kind of building, which is to contain or ſtand over water, has the moſt extraordinary effects, though laid on ever ſo thin. What wonders, therefore, might we not expect from this cement, were ſuch buildings to be originally conſtructed with it!

The duſt of charcoal incorporates very kindly with the ſame materials, in a quantity equal to that of the quick-lime; and, though the lead colour, which ariſes from this addition, makes no eſſential part of the mixture, it may ſtill have its uſes on certain occaſions; but, it is otherwiſe with regard to the bitumen contained in the charcoal; ſince this ſubſtance cannot but form a rampart extraordinary againſt the water, no way inferior to that afforded by the other materials with which it is made up.

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(11) See the obſervations hereafter to be made on the quality of the quick-lime.

If all we want is a ſtrong coating, then, by adding to the common mortar, conſiſting of ſlaked-lime and ſand, one fourth its quantity of quick-lime, we ſhall have one, which, within four-and-twenty hours, acquires a greater degree of conſiſtence, than the common kind in ſeveral months.

Two parts of air-ſlaked-lime; one, of ſifted plaſter; and a fourth, of quick-lime; made up into an amalgama of the conſiſtence of common mortar, afford a coating, no leſs fit for the inſide of buildings, than tenacious and incapable of cracking or flawing.

But then, we muſt, as in uſing the firſt preſcribed mixture, not prepare above a trough full at a time of theſe new ones; and that only juſt as we want to uſe them.

Inſtead of ſand, we may uſe looſe earth for buildings that are to be run up in a hurry, as likewiſe for the coating of walls, both within and without doors; but the more ſandy this earth, the better.

If we cannot conveniently get brick-duſt for thoſe works, which are occaſionally to receive, or conſtantly contain water, we may uſe the ſame kind of looſe earth as a ſubſtitute to it. It is only making it up into little balls; then baking them in a lime-kiln, by putting them behind the lime-ſtones, or in a kiln by themſelves; and laſtly reducing them to a powder, which they may eaſily be; for, this powder will do as well as brick-duſt.

A dry and ſtony free-ſtone, well powdered and ſifted, may be uſed inſtead of ſand and looſe earth; nay, it will anſwer better, on account of its extraordinary lightneſs, for any conſtructions that are to be ſupported by timber-work.

All kinds of marne, well waſhed, in order to deſtroy that unctuouſneſs of theirs, which, might otherwiſe prevent their taking to other ſubſtances, and carefully powdered, are equally proper to incorporate with both kinds of lime. Charcoal-duſt; (12) and, in general, all the vitrified ſubſtances afforded by furnaces, as well as the refuſe of foundaries and forges; in ſhort, every kind of rubbiſh impregnated with metallic bodies altered by the fire, is equally ſubject to the fetters of the mixtures made with the two kinds of lime; and may, of courſe, be uſefully employed to make cements of any colour we would chuſe to have them.

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(12) Aſhes are pernicious, and retard the ſetting of the lime.

Nor ought we in caſes of neceſſity to overlook pounded ſtone; ſo that the hitherto ſo uſeleſs heaps of ſtone chips, and diſtreſſing mountains of old materials ariſing from the demoliſhing of buildings originally conſtructed with lime and ſand, and which there is ſometimes, in the old way, a neceſſity for removing to a great diſtance, may, in this new one, be diſpoſed of on the ſpot to great advantage. The trials Monſieur Loriot has already made of them in the ſmall, are ſufficient to vouch for their ſucceſs in the great.

It is, however, but fair we ſhould warn thoſe, who are to collect the materials for this new cement, or mix them up, that, on account of the difference, in point of ſtrength, not only between the common kind of lime in one diſtrict and that in another, but even between different parcels of lime made of ſtones from the ſame quarry, according to the time elapſed ſince the burning of them, there is no aſſigning preciſely the exact quantity of quick-lime, that is to be added to every maſs of the common cement or mortar. In one place, we muſt uſe more; in another, leſs. It is for this reaſon, Monſieur Loriot has pitched upon a medium, in preſcribing, for any quantity of ſand and brick-duſt taken together, one fourth of their quantity of middling lime, when uſed juſt as it comes from the kiln; for, if on the one hand, it happens to be of a ſuperior quality; and, of courſe, capable of imbibing a greater quantity of water, in conſequence of its being made a harder ſtone; a ſmaller proportion of it will do; as, on the other hand, a larger will be neceſſary, if it has been long ſlaked.

The works in the neighbourhood of Paris begin to ſhew, that one third of the beſt lime it affords is not too much; but, this lime is not of as good a quality as the beſt common lime in moſt other places; nor this laſt equal to that of Senlis, which is the beſt we have. It is of the greateſt importance to be well acquainted with the condition and peculiar properties of the lime we are to uſe, as it is only from a juſt combination of it with the other materials we can expect a perfect whole. There is a quick-lime ſtrong enough to drink up, before it is perfectly ſlaked, a great deal more water, than is to be found in the mortar already deſcribed; ſo that the mixture made with them, inſtead of coaleſcing into a good cement, burns up, and falls to duſt; whilſt, on the other hand, ſome quick-lime, on account of its oppoſite quality, ſhall meet, in the ſame mortar, with more water than it can imbibe; and ſo form with it a compound, which, on the evaporating of the ſuperfluous moiſture, ſhall crack to pieces. I cannot, therefore, too ſtrongly recommend, even to workmen who have had the greateſt ſucceſs in other diſtricts, the trying of the ſtrength of the lime, they are about to employ. They ought, beſides, to be convinced, that, independently of any local advantages or diſadvantages in the nature of their lime, it ceaſes to be what it originally was, in proportion as it grows old, ſo as to require a proportionable encreaſe in the doſe of it; and that ſometimes even it may happen to be ſo bad, as entirely to ſpoil any work in which they ſhould be indiſcreet enough to employ it.

Therefore, to be always ſupplied with freſh lime, eſpecially for large and conſtant works, we ſhould have kilns like thoſe in the neighbourhood of Chartres, which are ſo many furnaces in the forms of chimneys; filled at top with alternate beds of fewel, and ſtone broken into ſmall pieces, and are to be emptied of their lime by a hole at bottom. Another equally conſiderable advantage, attending this method of making lime, would be that of enabling us to burn the ſtone, in a juſt proportion to its quality; for, we are not to imagine, that every kind of it requires ſo great a diminution of its weight by that operation, as is generally preſcribed, on the ſtrength of certain particular trials; and, the degree of this diminution being once aſcertained, all we ſhould have to do would be proportionably to encreaſe or leſſen our beds of fewel.

With regard to ſand, there are ſome kinds of foſſil ſand preferable to river ſand, on account of the grains of the latter being too much rounded and poliſhed by the friction, it is in moving water liable to undergo.

There are two different ways of preparing Monſieur Loriot's cement. The firſt is, to mix up very well, with water and ſlaked lime, the ſand, brick-duſt, or other materials, you chuſe to employ for the purpoſe, to the conſiſtence already preſcribed, that is ſomewhat thinner than uſual; then ſprinkle into the mixture your powdered quick-lime; and laſtly, incorporate the whole well together, to be uſed directly.

The ſecond way is, to mix up the ſand, brick-duſt, and powdered quick-lime, by themſelves, in the proportion preſcribed; then, adding to them, juſt as faſt as you want your cement, the proper quantity of ſlaked-lime and water, work the whole up well with the trowel. In this way, the ſand, brick-duſt, and powdered quick-lime, may be kept ready made up in ſacks, large enough to fill one or two troughs, ſo as ſcarce to leave the workmen any room to fail in the operation, let them be ever ſo ignorant or careleſs about it.

But, I muſt own, that all I have been ſaying might be looked upon as an idle declamation in Monſieur Loriot's favour, intended merely to heat the imagination and excite the curioſity of my readers, without any reaſonable proſpect of my being able to ſatisfy it, did I not give ſome proofs, that the ſucceſs of his cement in real works, of the moſt extenſive and various kinds, has not fallen ſhort of the merit attributed to it in conſequence of a few confined trials.

The firſt thing the Marquis de Marigny thought it his duty to aſcertain, with a view of rendering Monſieur Loriot's diſcovery uſeful to his majeſty, and the ſtate in general, both in civil and military, private and public architecture, was the ſurpriſing quality attributed to it of being impenetrable to water; of ſuſtaining and containing that element; nay, of acquiring under it a perfect degree of conſiſtence and tenacity; and all without flawing, or cracking, or ſhrinking, or ſwelling; and, with this view, he choſe ſome works perpetually expoſed to water for his firſt trials.

He had, it ſeems, to conſtruct, in his gardens at Menars, a baſon to ſupply a very conſiderable hydraulical machine; a canal, from forty to fifty toiſes long, to bring water to that

baſon;

baſon; and ſome ſubterraneous drains to carry off his waſte water.(13)

Now, there was not one of theſe works, in which he did not make uſe of Monſieur Loriot's cement; in one part of them, by way of a ſimple coating; where nothing more was wanting; in another, to bind together common ſtones huddled promiſcuouſly together; and in a third, to ſtop the ſluice of a canal he wanted to drain, in order to coat it from one end to another. The effect of the cement uſed for the laſt of theſe purpoſes, after common mortar, clay, and every other ſimple or compound ſubſtance generally uſed on ſuch occaſions, had failed, proved extremely ſudden and deciſive. It had ſcarce time to fill up the ſluice, when it withſtood the water to ſuch a degree, as to dry and harden completely, and in a very ſmall ſpace of time, whilſt the contiguous ſtones were viſibly ſweating at every pore.

The dome of a fountain, of very curious conſtruction, being found, in conſequence of the ſpongyneſs of the ſtones of the country with which it had been built, to give way to all the waters which happened to light upon it, and thereby render the leaſt ſtay under it diſagreeable and dangerous, the marquis had it coped with a layer of this cement; and the effect proved equally ſudden and ſatisfactory with that juſt now related with regard to the ſluice.

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(13) The Toiſe is equal to ſix French Feet; and the French Foot is almoſt three Quarters of an inch longer than the Engliſh Foot.

The baſon we juſt now took notice of, ſituate for the moſt part on the arch of a vault, containing all the moving parts of the hydraulical machine ſupplied by it, exhibits another ſtriking proof of the great advantages to be expected from this cement; and what adds to the wonder is, that all theſe trials were made in weather extremely unfavourable to them, viz. in autumn; in the beginning of the winter of 1772; and in the ſpring of the preſent year, 1773, during which the men were often obliged to work in the rain. In the latter end of October, 1772, they had ſcarce done coating a baſon in a yard, where the marquis intended to keep ſome water fowl, when a violent ſhower filled it to the height of ſix inches and upwards; yet the work never ſuffered by this ſevere trial; not a drop of the water penetrated; what eſcaped, was merely by evaporation.

It will, no doubt, be aſked, which of the foregoing compoſitions it was, that Monſieur Loriot gave the preference to in his ſeveral works at Menars; and it is but juſt I ſhould ſatisfy him.

The cement uſed in the grand-canal of the kitchen garden, forty-ſeven toiſes long, ſeven feet broad, and three deep; in that of the back kitchen garden; in that of the yard to keep water-fowl in; on the outſide of a vault, over which there now ſtands a ſhrubbery; on the dome of the fountain I have already taken notice of; as likewiſe in the maſſy part of a building, which conveys water to the machine; and, riſing ſeven feet within the baſon it ſupplies, ſerves as a vent, as well as to carry off the water at top to prevent its over-flowing, when it is not to be let into the little baſon of the machine; the cement, I ſay, employed in all theſe works, was that compoſed entirely of ſand and brick-duſt, with quick and ſlaked-lime. But, the coatings of this conduit, and the baſon at which it terminates, were made with the addition of powdered charcoal, in the proportion already preſcribed.

With regard to the coatings of the terrace walls, and ſome other parts of the building, the old plaſtering of which, yielding to the moiſture and other affections of the weather, uſed to peel off, every winter, he employed nothing in the compoſition of them, but the already preſcribed quantity of quick-lime added to common mortar made of ſlaked-lime and ſand, but ſomewhat thinner than for common uſe.

He likewiſe employed the ſame kind of cement for the placage of a ſubterraneous vault; and afterwards coated it over with the very white cement already ſpoken of, made with two parts of air-ſlaked lime, one of quick-lime, and one of plaſter. And here it is proper I ſhould obſerve, that lime ſlaked by the air alone, and in the ſhade, a circumſtance eaſily known by its being found crumbled to an impalpable duſt, may be uſed to advantage for the purpoſe of preventing the cement from ſetting as ſoon as it otherwiſe would; a thing of ſome conſequence in coating, when the operation requires any extraordinary degree of time and precaution.

As often as Monſieur Loriot had occaſion to lay his cement on the outſide of any vaults, over which there might be a neceſſity of peoples walking, he had recourſe in compoſing it, to coarſer materials than brick-duſt, ſand, and the like; by which means, without loſing any of its power to prevent the rain and wet from penetrating ſuch works, it rendered the paſſage along the inclined ſides of them leſs difficult and dangerous.

By what we have already ſaid, the reader may eaſily gueſs, what a great number of uſeful purpoſes this cement muſt anſwer; and what uncommon advantages it muſt, of courſe, afford in every branch of every ſpecies of architecture.

To begin with the moſt obvious, let the building be of what nature it will; and let the materials of it, of themſelves, afford each other ever ſo little hold by their ſides; or firm footing,

ing, if I may be allowed the expreſſion, through the ſmoothneſs and inclination of their upper and lower ſurfaces; this cement will, notwithſtanding, confer on them a degree of permanency and ſtability, which without it we could ſcarce expect from the beſt cut ſtone.

What arches, therefore, may we not expect from the uſe of it! how many uſeful and agreeable forms may we not now venture to give them! by means of this wonderful compoſition, we may make them almoſt as light as we pleaſe, and that, too, with the ſmalleſt, ſmootheſt and roundeſt pebbles, without any apprehenſions of their yielding, in any ſhape, to any reaſonable degree of preſſure.

Not only we may make aqueducts with it, but even pipes of any bore to raiſe water to any height, by juſt proportioning their thickneſs to the preſſure occaſioned by theſe two circumſtances.

By means of it, we may, in our canals and baſons, and all other works of that kind, ſave ourſelves the expence of abutments, clays, maſtichs, and ſuch other works and ſubſtances, which, after all, decay with time, and of courſe ſtand in need of continual repairs. No doubt, the beſt way by far would be to uſe this cement, even in the ſolid and maſſy parts of ſuch conſtructions; and, when they have been built in the common way, it will be neceſſary to look out for the joints, before we lay it on them.

Every kind of ſubterraneous conſtructions, whether civil or military, may, by means of this cement, be rendered, not only habitable, but even infinitely more healthy, than they generally are; and that, too, though ſurrounded by water; ſo that our cellars, eſpecially thoſe under court-yards and other open places; as likewiſe our neceſſaries; all now ſo ſubject, the former to be deluged on every riſing of the neighbouring rivers, &c. the latter, to convey infection to a great diſtance, by their contents ouzing through the adjacent earth; all theſe works, I ſay, may be eaſily cured by means of this cement, equally proper to keep water in or out.

In ſhort, what is it we may not make of, or with the aſſiſtance of, this plaſtic matter, and that at one caſt! watering troughs, ponds for ſtable and poultry yards, reſervoirs againſt fire; wholeſome ciſterns in fortified and other places, where no running or well water is to be had.

What floors, what cielings, what copings, what terraces, and that of any form, may we not promiſe ourſelves from this ſubſtance! We now need no longer ſuch weighty gutters of ſtone or lead, and, of courſe, ſuch maſſy walls to ſupport them; precautions, which, though ſo very expenſive, ſeldom anſwer the purpoſes for which they are intended. Inſtead of proving effectually impervious to rain or even the common dampneſs of the weather, they often bring to the ground the buildings they were intended to defend. And, in point of ductility, ſurely, neither tiles, nor ſlates, nor milled lead, can pretend to compare with this cement, for rills, drains, ſewers, capping for the ridges of roofs, and ſuch other works as require a curve or irregular ſurface.

Nay, whole roofs may be formed with it, by juſt placing the laths a little cloſer to each other than uſual, and then laying a coat of it on them; and, what is more, the ſlighteſt timber work will be ſtrong enough to bear the weight of ſuch a covering; a covering, which muſt be allowed of ſingular utility in places, where people are now obliged to put up with ponderous flag-ſtones; or a ſlight ſhingle, ſo liable to catch fire from every ſpark.

Both the exterior and interior ornaments of our buildings may likewiſe derive from this cement, not only the greateſt ſolidity, but the moſt pleaſing variety. But, in this uſe of it, care muſt, no doubt, be taken, not to apply it, either in the way of pargetting, or of ornaments in relievo, to any walls but ſuch as are perfectly dry, leſt it ſhould concenter ſome deſtructive particle, which, in proceſs of time, might make their way out; and ſuch works themſelves ſhould have time to dry perfectly, before any froſt can get at them.

Moreover, this cement, eſpecially that kind of it, which has powdered ſtone in its compoſition, is, of itſelf, an artificial ſtone, which may be caſt in a mould, and formed into baluſtrades and pilaſters, for the ſupport of terraces and platforms; and flights of ſtairs with all their appendages both uſeful and ornamental, ſtraight and curvilinear; though, for greater ſafety, it may not be amiſs to beſtow a rude iron core on the pilaſters, &c. whoſe ſlenderneſs and height may ſeem to require ſuch an addition.

We might, likewiſe, make it, by caſting it in moulds, or faſhioning it on the potters' wheels, into flower-pots, and even other leſs reſidentiary veſſels, for gardens and parterres, and that of any colour we like beſt.

There are ſeveral of our provinces, and ſeveral countries in Europe, where there is not a bit of plaſter to be found; and where, of courſe, the dearneſs of it has proved an inſurmountable obſtacle to the execution of a great number of the moſt uſeful works, particularly with regard to chimneys. But, henceforward, by means of this diſcovery of Monſieur Loriot's, any kind of work may be carried on, in any place, with the ſame cheapneſs and eaſe, as in diſtricts where plaſter is to be had in the greateſt abundance.

There is, indeed, one very curious art, that of ſculpture, to which Monſieur Loriot cannot as yet take upon him to affirm, that this cement of his may be made ſubſervient, ſo far as to ſupply the place of plaſter, clay, and other leſs ſolid ſubſtances, liable to ſhrink or ſwell. It is, however, already paſt doubt, that the cement is very proper to obtain the hollow moulds of ſuch figures as we would wiſh to copy; and Monſieur Loriot hopes, that, with the advice and aſſiſtance of the famous artiſts of our capital, he ſhall, ſome day or other, be able to contribute ſomething, on his ſide, to the ſervice of the art, which they ſo aſſiduouſly cultivate. In the mean time, he will always be ready to anſwer any letters addreſſed to him, concerning the poſſibility or probability of applying his cement to any other purpoſes.

For our parts, we have nothing more at preſent to ſay concerning the diſcovery and compoſition of this cement, and the manner of uſing it. Monſieur Loriot has made no ſecret of any thing, not even of his private thoughts with regard to ſeveral particular uſes, to which he can at preſent but juſt ſuppoſe it may be applied, as he has not as yet had any opportunity to make actual trials of it, in the great, for ſuch purpoſes. But, if, on the one hand, he has had nothing more at heart, than to ſatisfy

tisfy the curioſity expreſſed by the public, as ſoon as it came to be known, that his majeſty had ordered the ſecret to be publiſhed, that every one, who choſe, ſhould be able to take advantage of it; ſo, on the other, he hopes, that the ſame public will vouchſafe to value his diſcovery, not ſo much by the ſimplicity, as by the uſefulneſs of it; not ſo much by the eaſe, with which it may be put in practice, as by the length, aſſiduity, and painfulneſs of the enquiries and reſearches of which it is the fruit, and of which, they are now enabled to reap the benefit at free coſt.

It is, however, proper we ſhould here warn ſuch perſons, as may have works to execute, in which Monſieur Loriot's cement can be uſeful, not to impute to him any blunders, that may be committed in the compoſition or uſe of it, by perſons taking upon themſelves to be maſters of his method, without ever adding any practice to the theory they may acquire by the peruſal of this eſſay; it being of the utmoſt importance, in every art, to unite them. For this reaſon, Monſieur Loriot, while he is employing, in his majeſty's works, and thoſe of the reſt of the royal family, the workmen firſt formed by him at Menars, will not grudge the trouble of inſtructing all others, who may offer themſelves for that purpoſe, provided they do not think it beneath them to put, themſelves, a hand to the work; and then, as ſoon as he thinks them perfect, will give them a certificate of their having ſerved this kind of apprenticeſhip, on ſight of which any one may ſafely employ them. He will even render them capable of inſtructing others. And, ſhould any province or town apply to him for perſons ready for both theſe purpoſes, he will, to forward their patriotic views, make it his buſineſs to ſend them ſome of his beſt hands.

FINIS.